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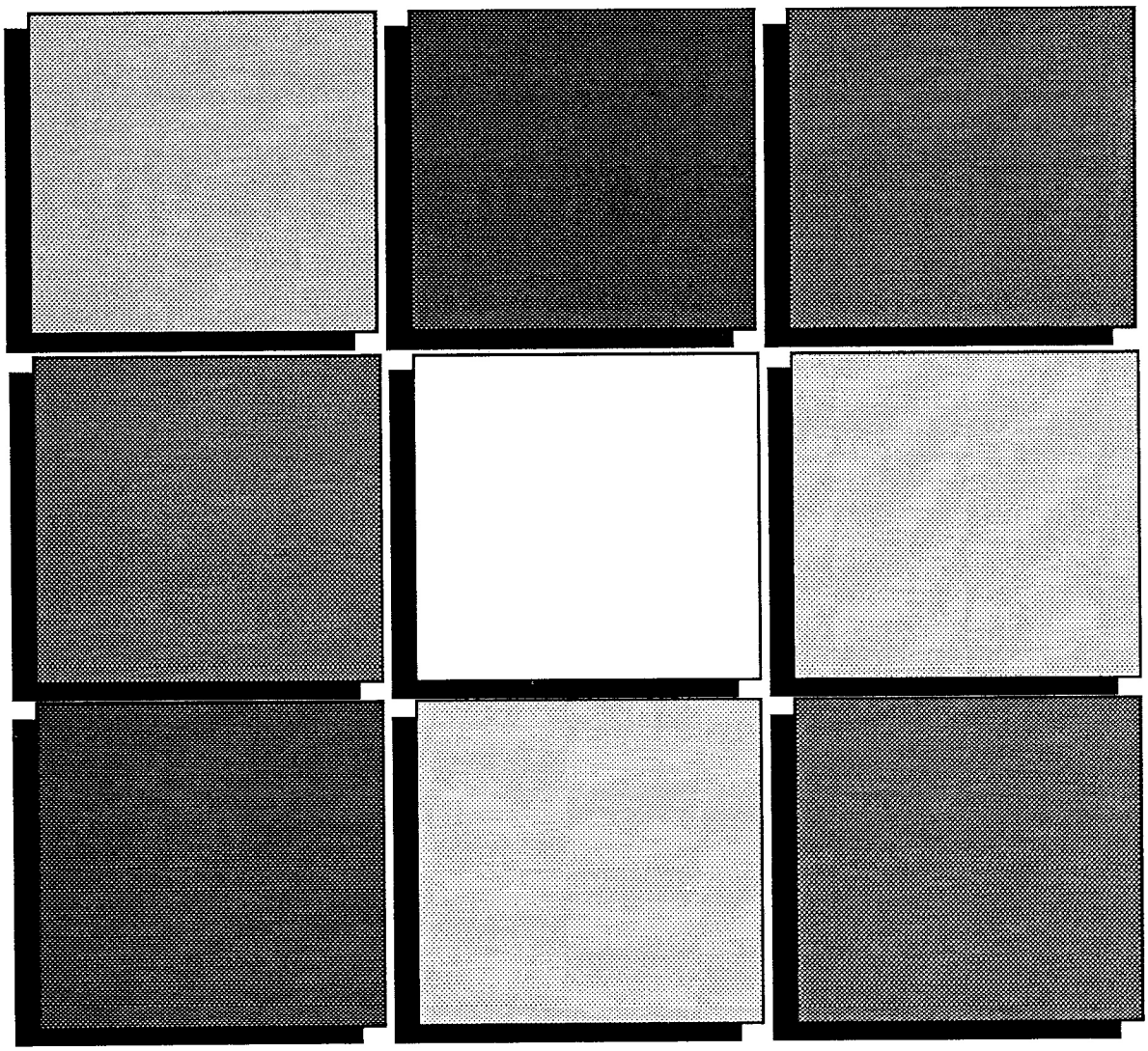

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## Ventura Educational Systems

3440 Brokenhill Street
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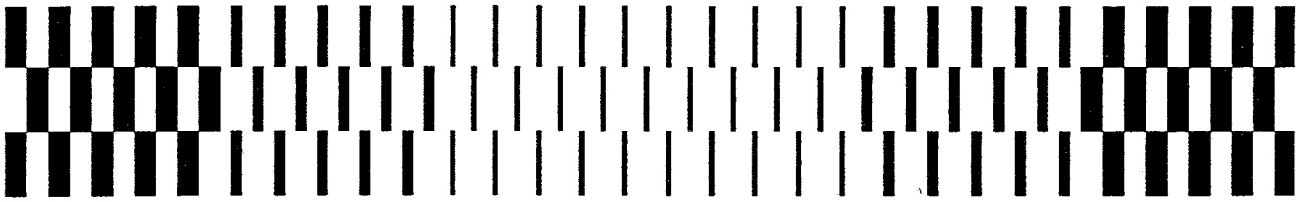
# Hands-On Math:
## Understanding Place Value using Base Ten Blocks
***Learning with Computers and Math Manipulatives***



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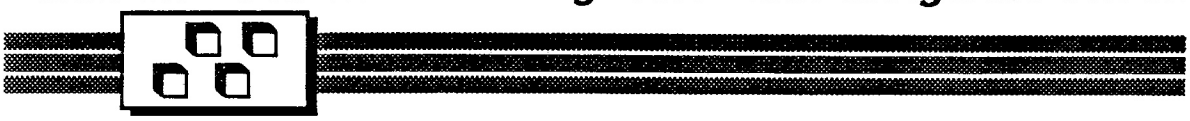

**Credits**

| | |
|---|---|
| **Software Design** | **Ventura Educational Systems** |
| **Instructional Technology and Programming** | **Fred Ventura, Ph.D.** |
| **Editor** | **Marne Ventura, M.A.** |

Dr. Fred Ventura is an experienced classroom teacher and has taught elementary, secondary and college levels. He holds a doctorate in education from the University of California, and presents workshops for educators on the instructional uses of microcomputers.

Marne Ventura is also an experienced classroom teacher and holds a masters degree in reading and language development from the University of California. As a seminar leader, Marne Ventura has assisted many teachers in learning about the educational opportunities that can be derived from the use of microcomputers in the classroom.

Other publications include:

SuperGraph
GeoArt: Geometry and Art Discovery Unit
Marine Life: Anatomy of a Fish
Anatomy of a Sea Lamprey
Senses: Physiology of the Human Sense Organs
The Plant: Nature's Food Factory
Chemaid: Introduction to the Periodic Table
The Worm: Invertebrate Anatomy
Protozoa: Introduction to Microorganisms
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Music Concepts
VisiFrog: Vertebrate Anatomy
Computer Concepts
Plant and Animal Cells
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All About Light & Sound
Algebra Concepts
Beginning Geometry

## Additional Program Disks

Many schools have more than one computer and to effectively use educational software require additional legal copies of a program. Additional program disks are available for use in a computer lab. The price is $10.00 per disk. Schools with a registered copy of any Ventura Educational Systems product may order additional copies of a program disk at any time. There is a 30 day warranty on original program disks. If for any reason a program disk becomes defective within 30 days of the date of purchase, Ventura Educational Systems will replace it at no charge.

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## Using a Computer in a Manipulative Approach to Math

Approaches to the teaching of mathematics that rely heavily on one methodology are inherently weak and unlikely to produce optimal results. Educators have found that teaching strategies must adapt to accommodate new discoveries which expand our understanding of the learning process and new technologies which expand our delivery systems.

According to current learning theory, children learn best when they are actively involved in the learning process. There are many ways to do this but one example is having children work in small groups in a laboratory/discovery situation. Small group instruction encourages variation in teaching methodology. Varying the way in which material is presented serves the instructional process since one particular methodology may not be best for all children. Different children respond differently to a particular educational approach. The same methodology that is appropriate for one content area may not be as effective with a different content area.

For learning mathematics an active teaching and active learning situation is a very desirable educational environment. To create it the teacher must be aware of the behavioral characteristics of the students with regard to mathematics, must be knowledgeable in the particular skills which are being taught and must be able to draw upon diverse strategies in order to decide which is the most appropriate for fostering the development of the targeted mathematical concepts.

In general, educational psychologists believe that the ability of children to learn passes through developmental stages. Each stage is characterized by particular behaviors. In the early stages learning is tied to perceptual responses. As the child matures, abstract reasoning becomes possible and concrete models are useful for laying the conceptual groundwork for new ideas but once a concept has been internalized the concrete models are no longer necessary. The work of the Swiss psychologist, Jean Piaget, has contributed a great deal of support to this theory, and has fostered the development of new educational strategies which are consistent with the theory.


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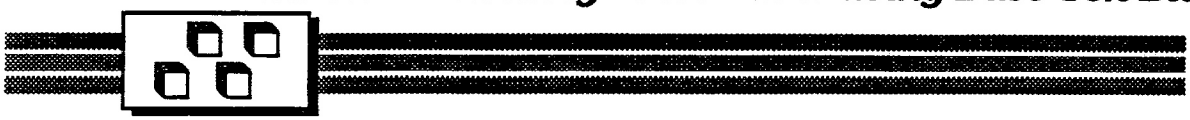

## Introduction to Hands-On Math: Understanding Place Value using Base Ten Blocks

The Hands-On Math series combines the use of concrete materials for teaching mathematics with the use of the computer. When used in conjunction with actual manipulative devices the program offers a unique set of strategies for active learning. While using this program students can draw upon concepts developed from concrete experiences that were gained using manipulative devices and will work with the same concepts in a more abstract manner at the computer. In this way the child's concrete mathematical knowledge is used as a foundation for the development of abstract mathematical thinking skills. Once mathematical concepts have been internalized by the child in a concrete way, the stage is set for an understanding of the more formal, abstract axioms of higher mathematics.

Understanding Place Value using Base Ten Blocks simulates the use of a set of base ten blocks. The Playground provides children with a free-form work area where they can express mathematical concepts. Using the Playground students demonstrate their understanding of math by moving objects on the screen. In this environment students will enjoy self-expression and also experiment with mathematical ideas. The Playground is also used with lessons that present mathematical concepts in a structured way. In addition to the Playground, an Exercise can be selected for this manipulative. Reproducible activity pages are provided to guide students through the use of the program and provide examples of the learning tasks that students can do with the program. The examples in this teacher's guide are designed to suggest ways in which Understanding Place Value using Base Ten Blocks can be integrated with the traditional curriculum.

### Hardware Requirements

Hands-On Math is designed to work with an Apple //e, //c or //GS or compatible computer system. The hardware requirements are listed below:

Apple //e, //c or //GS or compatible computer system
Single or Dual Disk Drive (5.25" or 3.5")
64K RAM
Video Monitor (Color Recommended)
Imagewriter Graphics Printer (optional)

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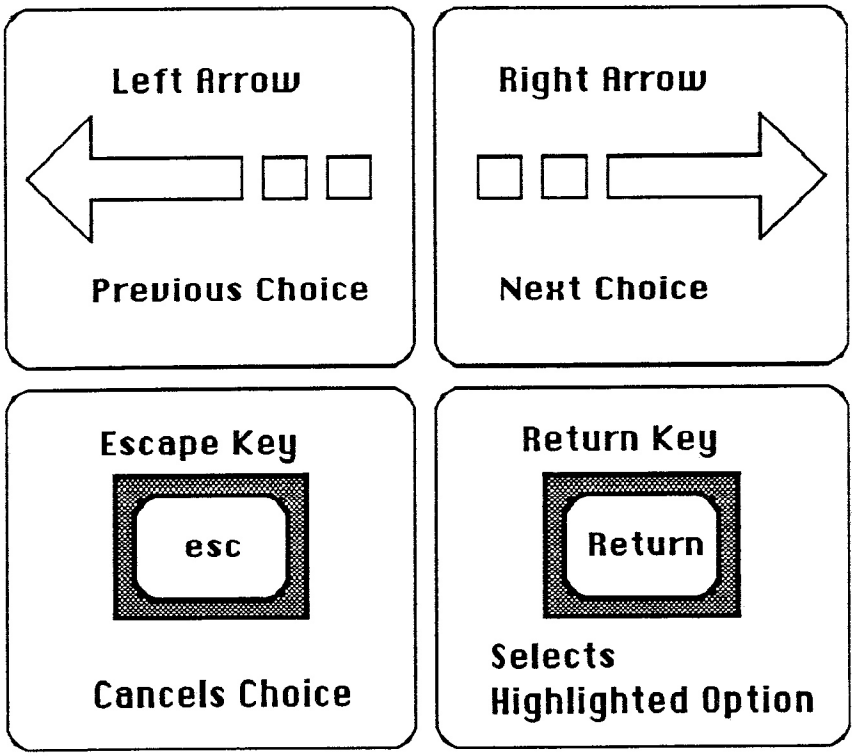
## Getting Started

To start this program follow these simple steps:

1. Place the program disk in the disk drive.
2. Power on the system or use (CTRL-Open Apple-Reset) to boot the system.

## Menu System

Understanding Place Value using Base Ten Blocks encourages exploration. The program is designed in such a way that the physical operation of the computer does not interfere with the learning activity. Control over the program is exercised by the use of four keys. Each key has a consistent function throughout the program.




The initial menu provides two choices: Playground or Exercises. While this menu is show the student can press the "S" key to activate or deactivate sound.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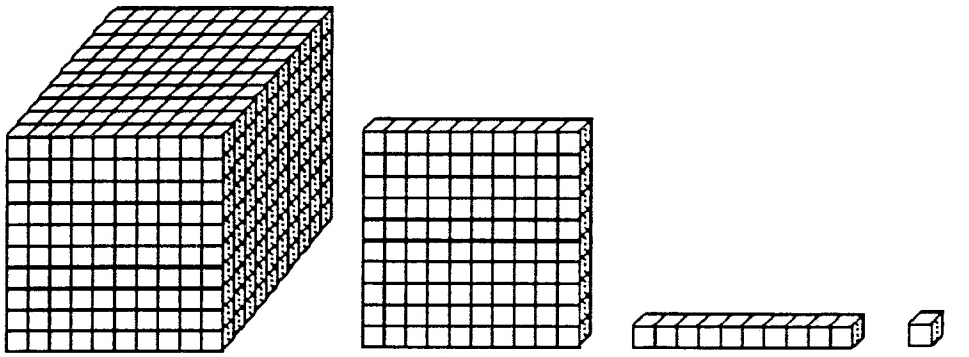
## The Base Ten Blocks Playground

The Base Ten Blocks Playground helps the child develop an understanding of place value. In order for a child to develop a meaningful understanding of mathematics it is essential that the child know the underlying concepts that are the cornerstone of the representational place value system. After a child has developed a clear understanding of addition and subtraction as operations involving the joining and separating of sets, he is ready to begin the systematic study of numbers greater than 9.

The decimal system employs only ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Children must learn that the position of a given digit in a number determines its value. For example, in the number 387 the 3 represents 3 sets of one hundred, the 8 represents 8 tens and the 7 represents 7 ones.

The Base Ten Blocks Playground provides children with an opportunity to freely explore place value concepts. The Playground uses four types of blocks.



Thousands Hundreds Tens Ones

Using this special playground the child can select and individually place base ten blocks anywhere on the screen. After Begin is selected from the menu bar the options Thousand, Hundred, Ten and One appear. If Thousand is selected the computer will display a thousands block. Using the arrow keys the block can be moved up, down, right and left. Return places the block and restores the menu. In a similar way hundreds, tens and ones blocks can also be placed.

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The Options menu provides access to these operations:

**Clear** Select Clear to remove all the blocks from the screen and reset the memory.

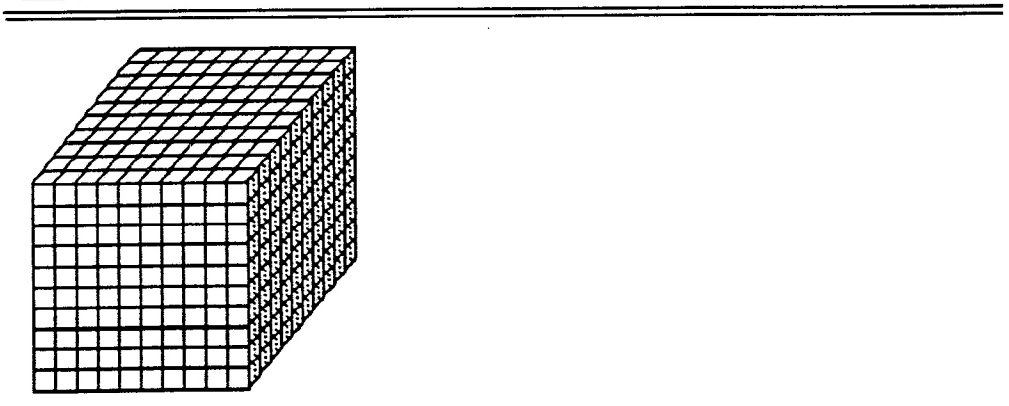
**Count** Count the blocks that have been placed to determine the value of what is showing on the screen.

**Arrange** The arrange option allows the student to select and move blocks that have already been placed.

This example will demonstrate how the base ten blocks can be placed on the Base Ten Block playground to represent a specific number. Teachers will want to lead children in similar activities which can be very helpful in developing a fundamental understanding of place value. In this example you will use the Base Ten Blocks to represent the number 2,375.

**Step-by-step**:

1. After selecting the Base Ten Blocks Playground from the menu the menu bar will display the choices Begin, Options, and Exit. Choose Begin.
2. The next menu offers the choices: Thousand, Hundred, Ten and One. Since the number that we want to represent has 2 thousands, press return with the thousand choice highlighted. A thousands cube appears on the screen. Use the arrow keys to move the block up and press return to place the block. (Note: To avoid confusion it is best to always move a block away from the starting position.)





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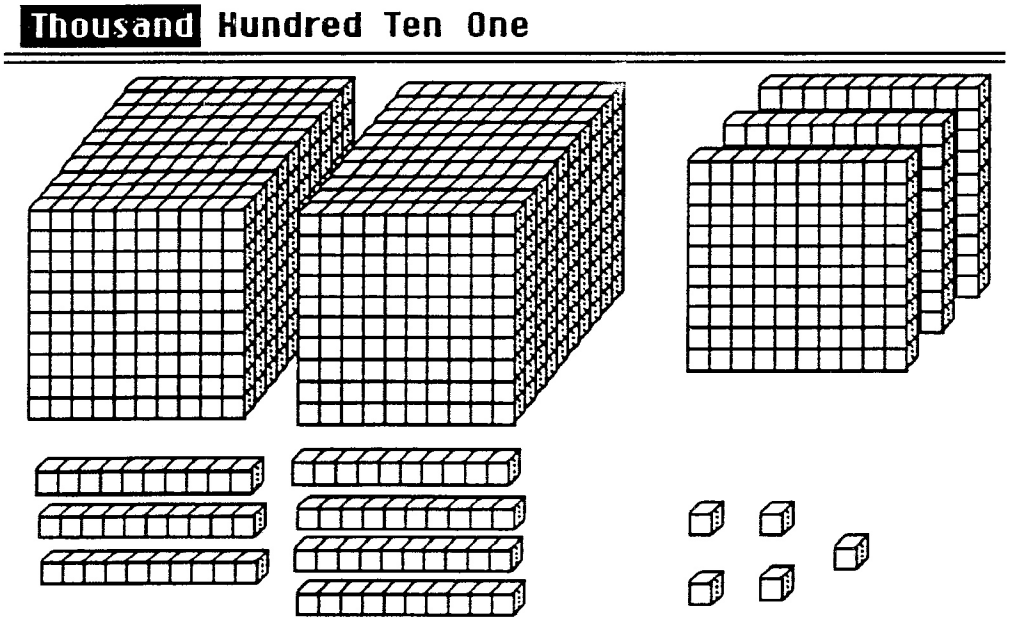
3. Continue selecting blocks from the menu bar and placing them on the screen until 2 thousand blocks, 3 hundred blocks, 7 ten blocks and 5 one blocks have been placed.




4. After all the blocks have been placed press the escape key and the menu bar shows the choices: Begin, Options, Exit. Choose Options and then Count. Watch as the program steps through each block that has been placed and adds the value of the block to the counter. The number 2,375 will be shown on the menu bar. Press any key to restore the options menu. Choose Clear and then Ok to try another problem.

## Instructional Applications

The place value system is based on the concept of groups. Using Base Ten Blocks, children develop an understanding of grouping in powers of ten. Activities which involve representing numbers using Base Ten Blocks or telling which number is represented by a set of blocks reinforce a child's comprehension of the decimal number system.

Because the computer graphics used in the program allow objects to 'pass through' other objects children can easily discover that a ten block may be exchanged for 10 one blocks. By manipulating physical materials and then by simulating the manipulation of physical materials using the computer children are given the opportunity to internalize the basic ideas of the decimal place value system.

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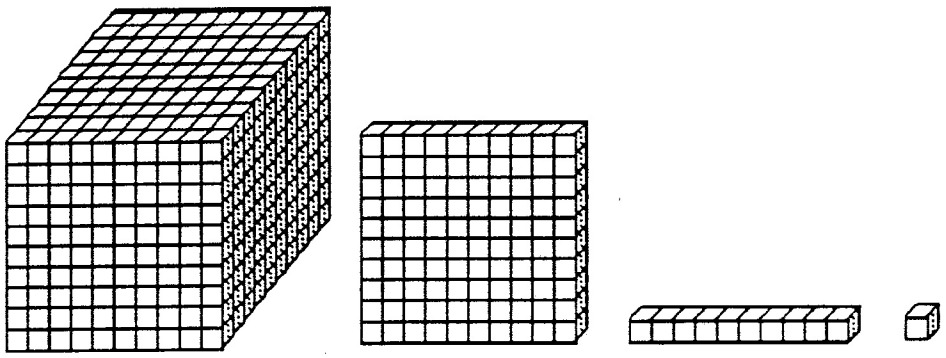
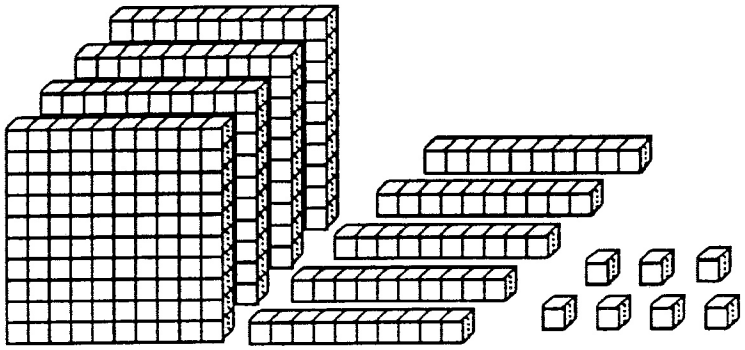
Some suggestions for worthwhile activities are the following:

1. Tell the name and give the dimensions of each block.



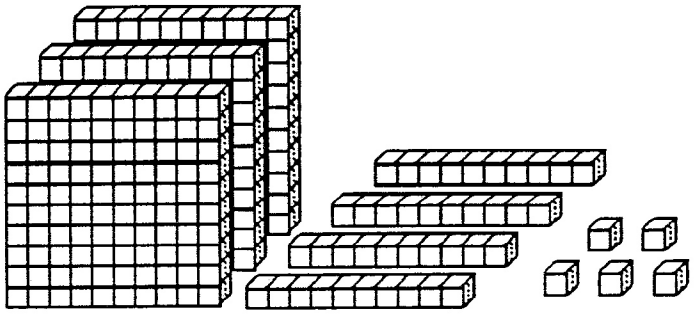
2. Give the value of the number represented by a set of blocks.



= 457

3. Represent a given number with blocks.

345 =





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## Base 10 Blocks Exercises

If instead of choosing Playground, the return key is pressed with the highlight on Exercises, two more choices appear: Naming Sets and Addition Skills. These exercises use the Base Ten Blocks model to present problems and check for students understanding of basic arithmetic concepts.

### Naming Sets

Objectives: State the number when given a representation of a number using base ten blocks. Represent numbers using base ten blocks.

The Base Ten Blocks Place Value exercise challenges the student to enter the correct number given a representation of the number using base ten blocks. The options available in the program allow teachers to individualize each student's experience.

The options menu used in the Naming Sets exercise presents these choices:

**Clear** Select Clear to remove all the blocks from the screen and leaves the Goal and Zero setting unchanged.

**Goal** The goal is the number of problems needed to complete the activity.

**Zero** The Zero option gives the user control over the type of problem that is presented. When the Zero option is "On" problems may be presented with a zero in either the ones, tens or hundreds place. When the Zero option is "Off" the use of zero is eliminated and at least one block for each place value position will be shown. The randomly generated problems will not contain a zero.

Choose Begin to start the activity. The computer screen displays a set of blocks and a prompt is shown at the top of the screen. The program will display a set of blocks and the question, "What is the value of these blocks?" will appear on the menu bar. Press any key to continue and the input prompt will appear. Enter the answer and press return. For the example shown below the student would enter: 1,434. If the answer is correct the computer prints the word 'Correct!' and the current score. When an incorrect answer is given the student is given a second chance. If the problem is answered incorrectly a second time the correct answer is given. The object is to reach the goal selected using the option menu. The default goal is 10

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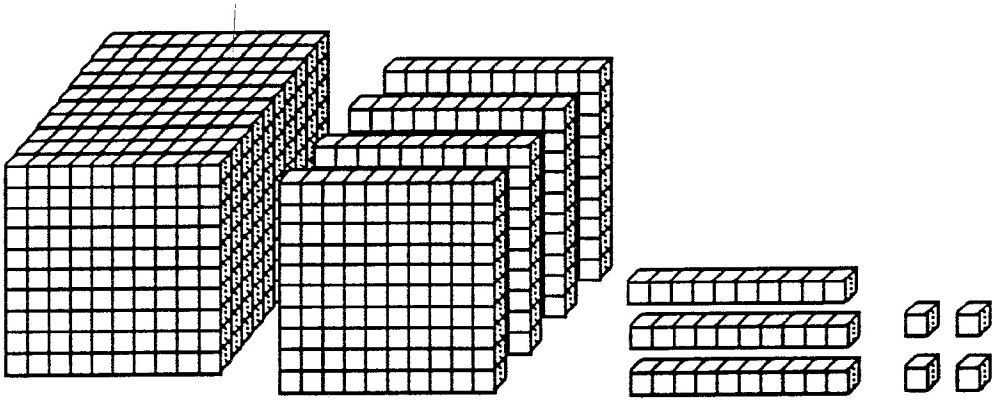
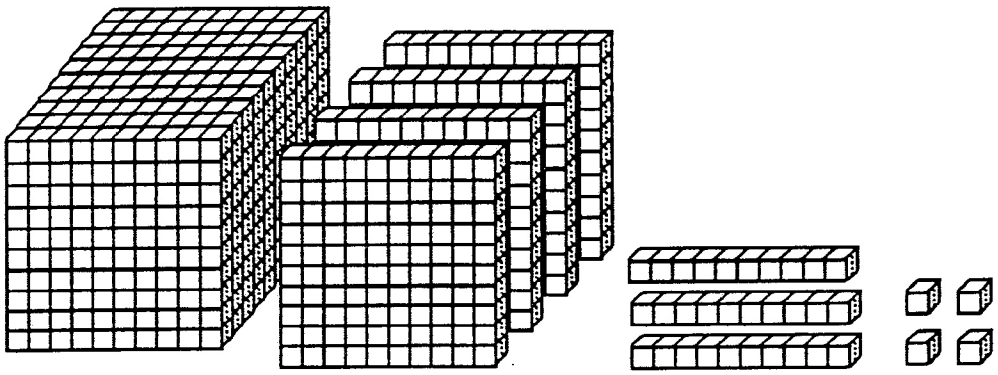
problems. To quit before completing the exercise press return when asked to enter an answer.

## What is the value of these blocks?



Press any key after the problem is displayed and the computer will prompt the student to enter an answer.

## Enter your answer:



When a correct answer is given the computer will generate a new problem and add one to the score. The student continues stating the value of the blocks shown until the goal is reached.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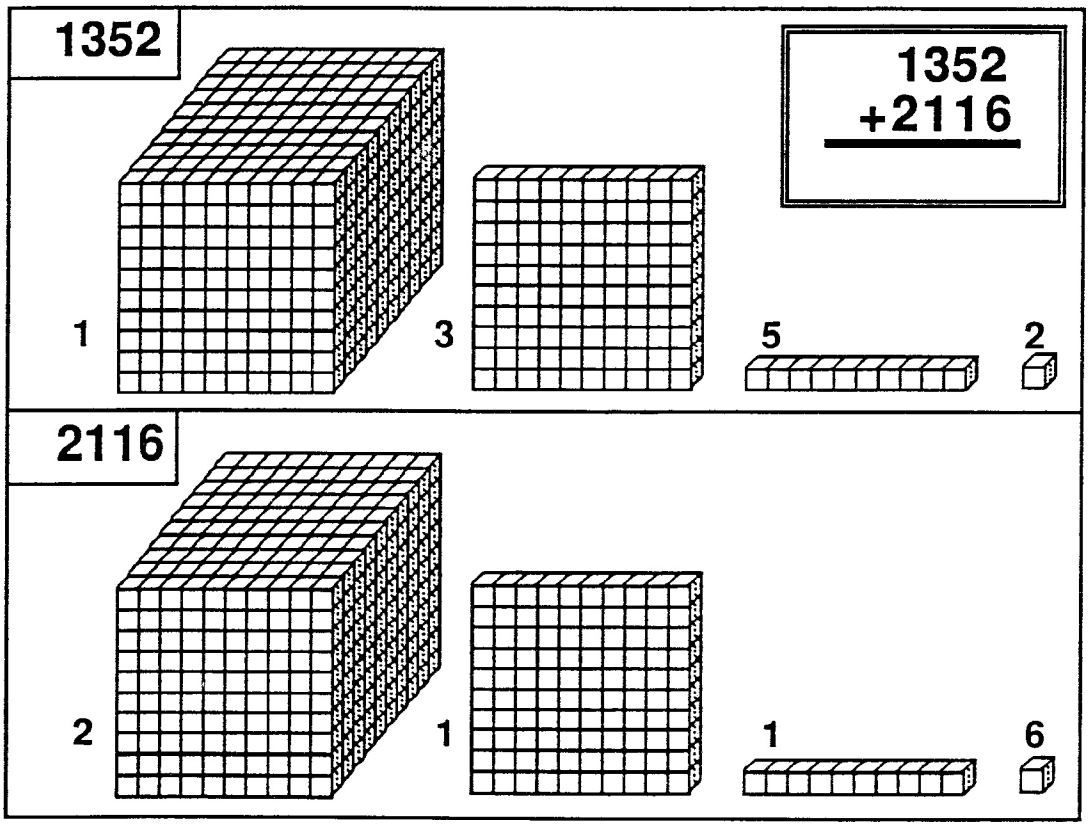
**Addition Skills**

Objective: View of model of the addition process and decide when it is appropriate to regroup.

The Base Ten Blocks Addition Skills exercise challenges the student to select whether or not it is appropriate to regroup as a model of the addition process is presented. Teachers can individualize each student's experience using the options which are available in the program.




**Random** The Random option can be set "On" or "Off". When it is "On" the program presents random problems. When Random is "Off" the student is prompted to enter the addends for the problem.

**Thousands** Selecting Thousands sets up the program to generate four place addends. (Thousands Place)

**Hundreds** Selecting Tens sets up the program to generate three place addends. (Hundreds Place)

**Tens** Selecting Tens sets up the program to generate two place addends. (Tens Place)

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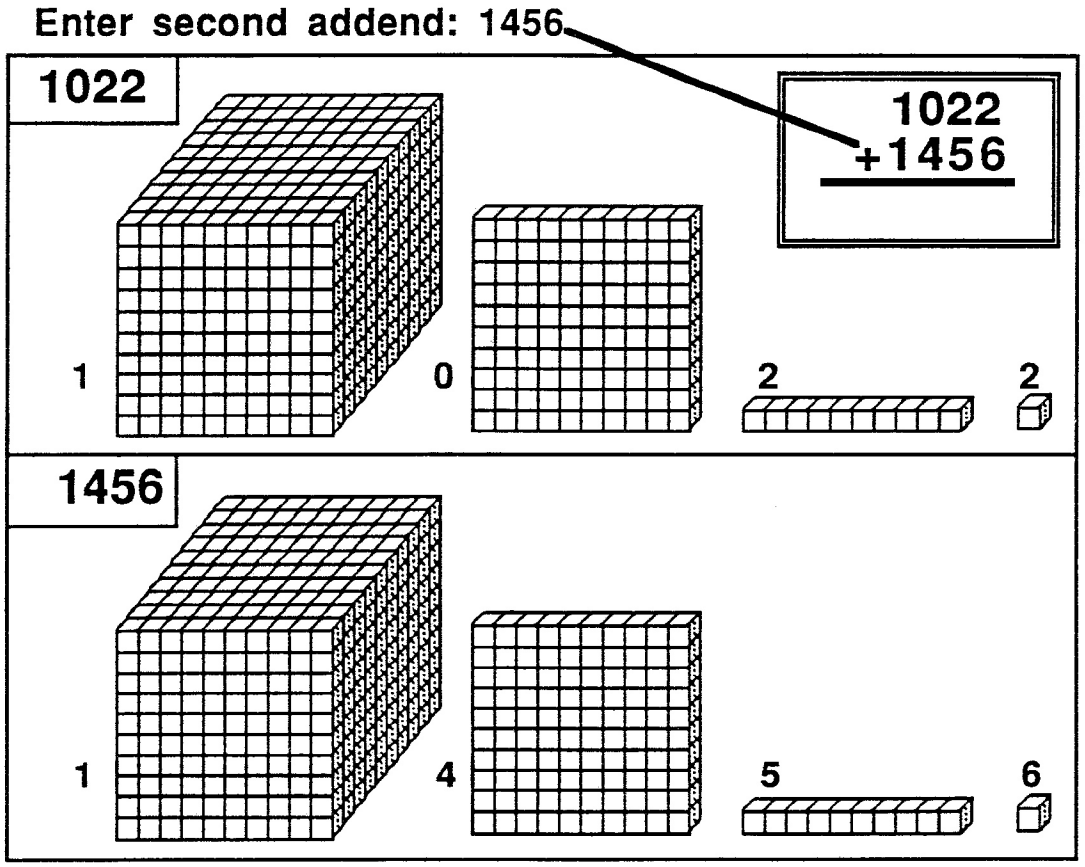
When the Random Option is set to "Off" the program can be used to help students solve addition problems with regrouping. Problems from the students text book or worksheets can be entered. After student enters the values for the first and second addend, the computer models the addition with regrouping process.





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# Activity Pages

The following pages may be reproduced for classroom use. These pages serve as a guide for students who are using the Hands-On Math program.

**Base Ten Blocks** **Pages**

Representing Numbers with Base Ten Blocks ..... 1-4

Decisions, Decisions ..... 5

Base 10 Block Cut-Outs ..... 6-7

Base 10 Paste Up ..... 8-9

Writing Numbers in Expanded Notation ..... 10

Four Place Addition with Regrouping ..... 11

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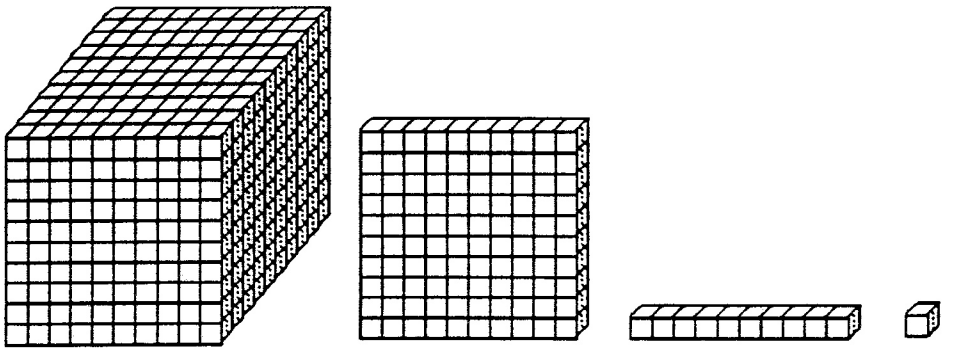
Name:_____ Date:_____

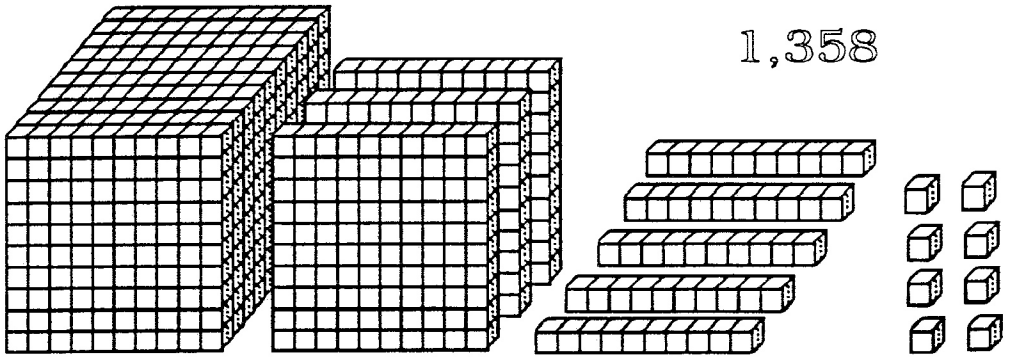
## Representing Numbers with Base Ten Blocks

We use a decimal system to represent numbers. The position of a digit in a number determines its value. The blocks represent the place values used in the decimal system.



***Thousands*** ***Hundreds*** ***Tens*** ***Ones***

In this set of blocks there is 1 thousands block, 3 hundreds blocks, 5 tens blocks and 8 ones. This set of blocks represents the number 1,358.




Use the Base Ten Blocks Playground to represent these numbers. Place the blocks on the screen equal to the number given. Select Count from the Options menu to check your work. Put a check mark in the box when you get the problem correct.

| | | | | | |
|---|---|---|---|---|---|
| 1. | 2,145 | | 2. | 1,453 | |
| 3. | 1,048 | | 4. | 1,206 | |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Name:_____ Date:_____

Continue using the Base Ten Blocks Playground to show the numbers on this page. After you have placed blocks on the screen, select Count from the Options menu to check your work. Remember to put a check mark in the box when you get the problem correct.

| | | | | | |
|---|---|---|---|---|---|
| 5. | 2,108 | | 6. | 2,335 | |
| 7. | 1,052 | | 8. | 1,030 | |
| 9. | 309 | | 10. | 1,284 | |

Write the place value of the 4 in each number given below.

| Thousands | Hundreds | Tens | Ones |
|---|---|---|---|

1. 3,485 _____ 2. 2,545 _____

3. 3,764 _____ 4. 2,541 _____

5. 4,875 _____ 6. 5,047 _____

7. 1,499 _____ 8. 1,949 _____

9. 2,040 _____ 10. 3,469 _____

Write a number for each problem.

1. Two thousand three hundred fifty-six. _____
2. Three thousand seventy-five. _____
3. Four thousand two hundred twenty-six. _____
4. Eight thousand twenty-nine. _____
5. Five thousand one hundred twelve. _____

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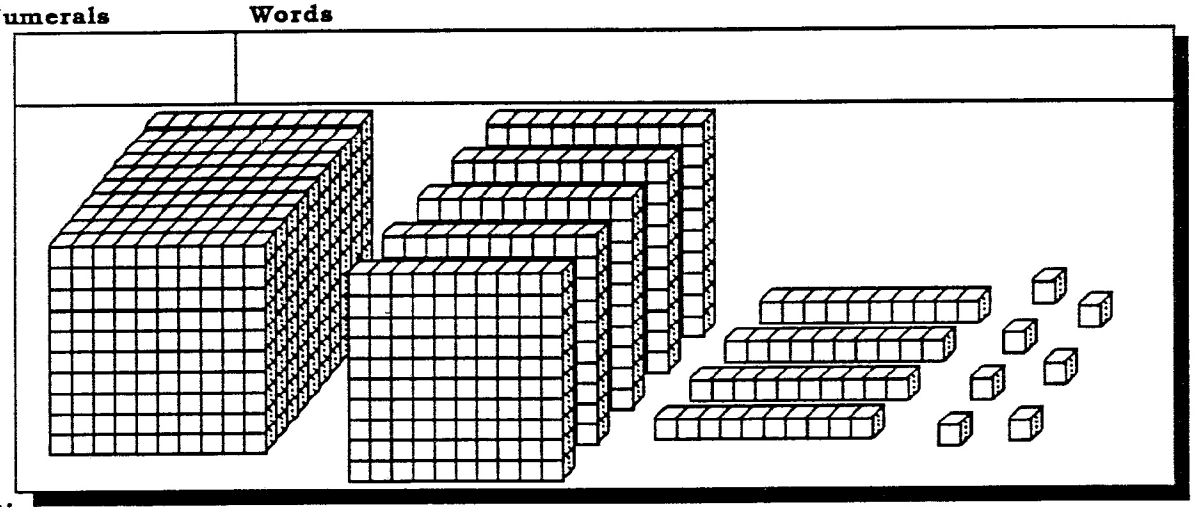
Name:_____ Date:_____

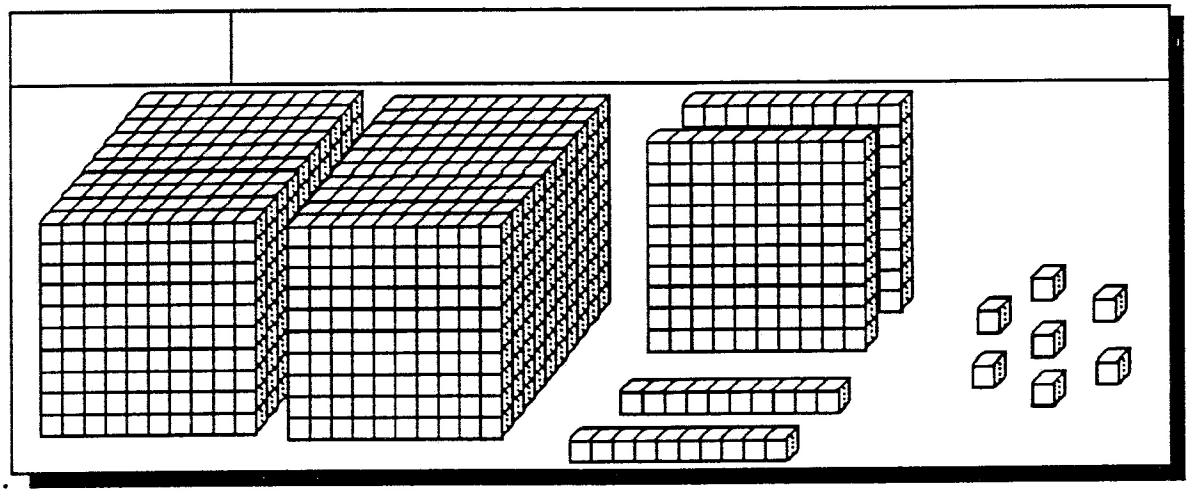
In each problem write the number represented by blocks in numerals and in words.

| Numerals | Words |
|---|---|

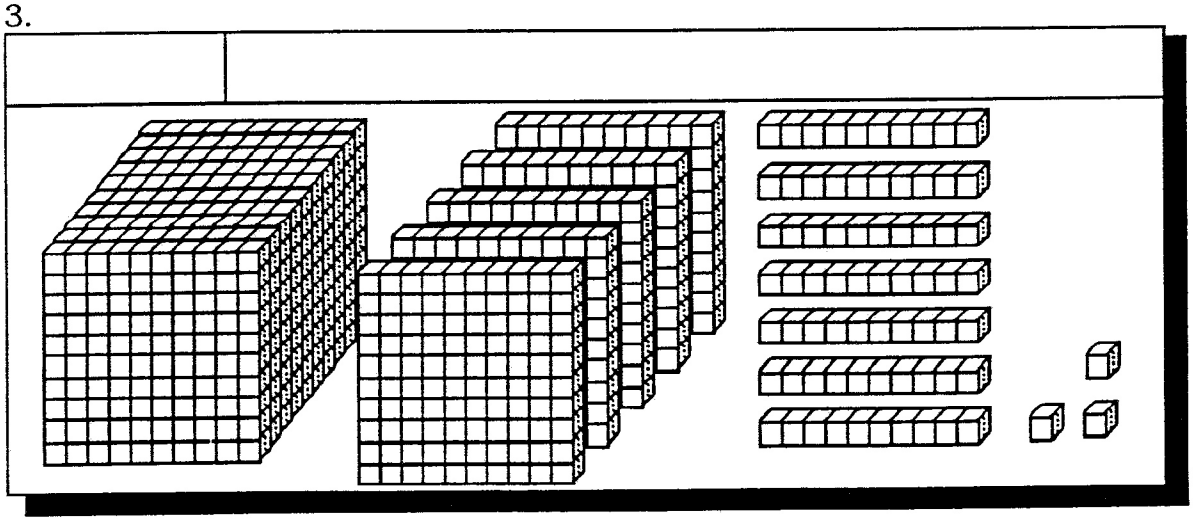
1.



2.



3.

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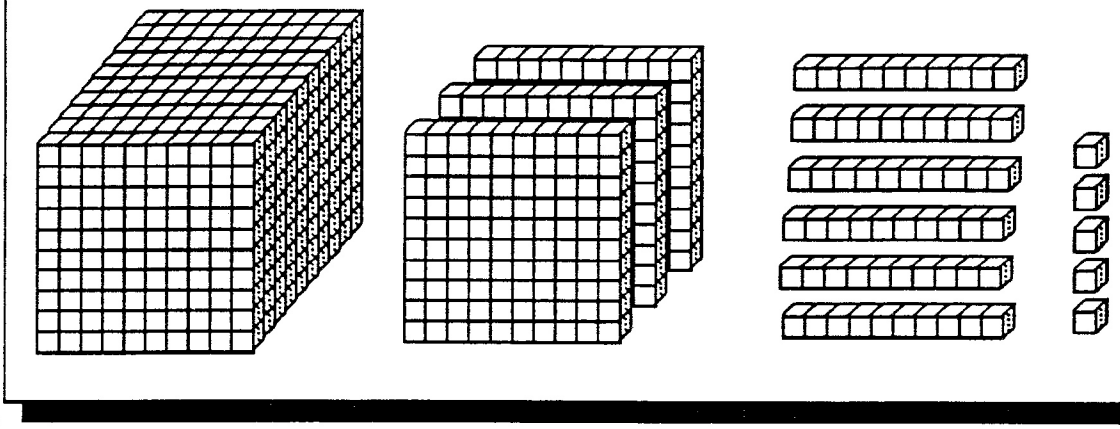
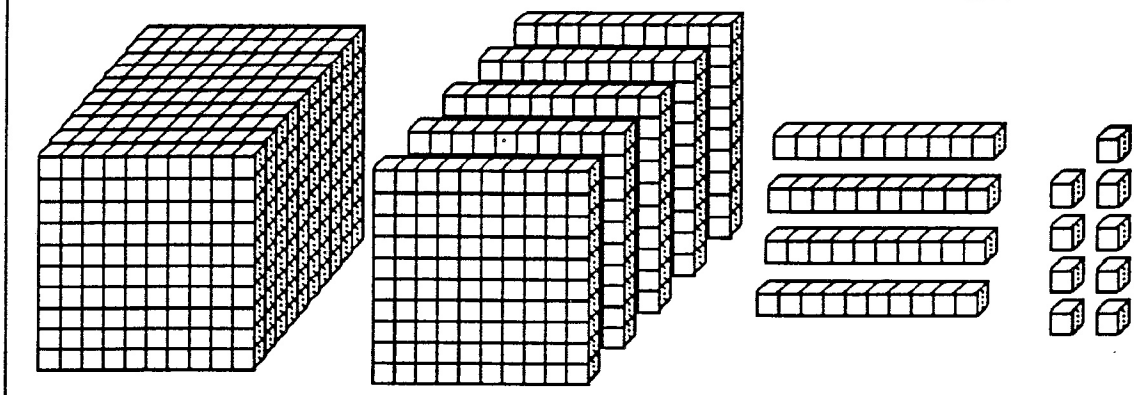
Name:_____ Date:_____

**Numerals** **Words**

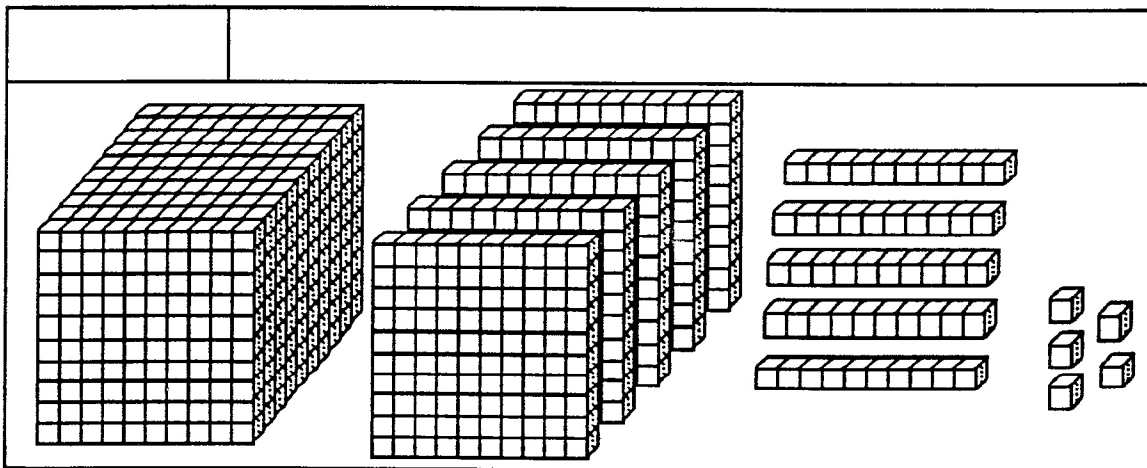
4.



5.



6.



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## Decisions, Decisions

Study each problem. Circle **Yes** or **No** to tell if regrouping is needed.

1. 3029 + 198 — Regroup? **Yes** **No**

2. 4687 +3212 — Regroup? **Yes** **No**

3. 3297 +5178 — Regroup? **Yes** **No**

4. 6743 +1098 — Regroup? **Yes** **No**

5. 3029 + 198 — Regroup? **Yes** **No**

6. 1102 +2356 — Regroup? **Yes** **No**

7. 2990 +5291 — Regroup? **Yes** **No**

8. 8235 +1421 — Regroup? **Yes** **No**

9. 1029 +1091 — Regroup? **Yes** **No**

10. 3276 +1678 — Regroup? **Yes** **No**


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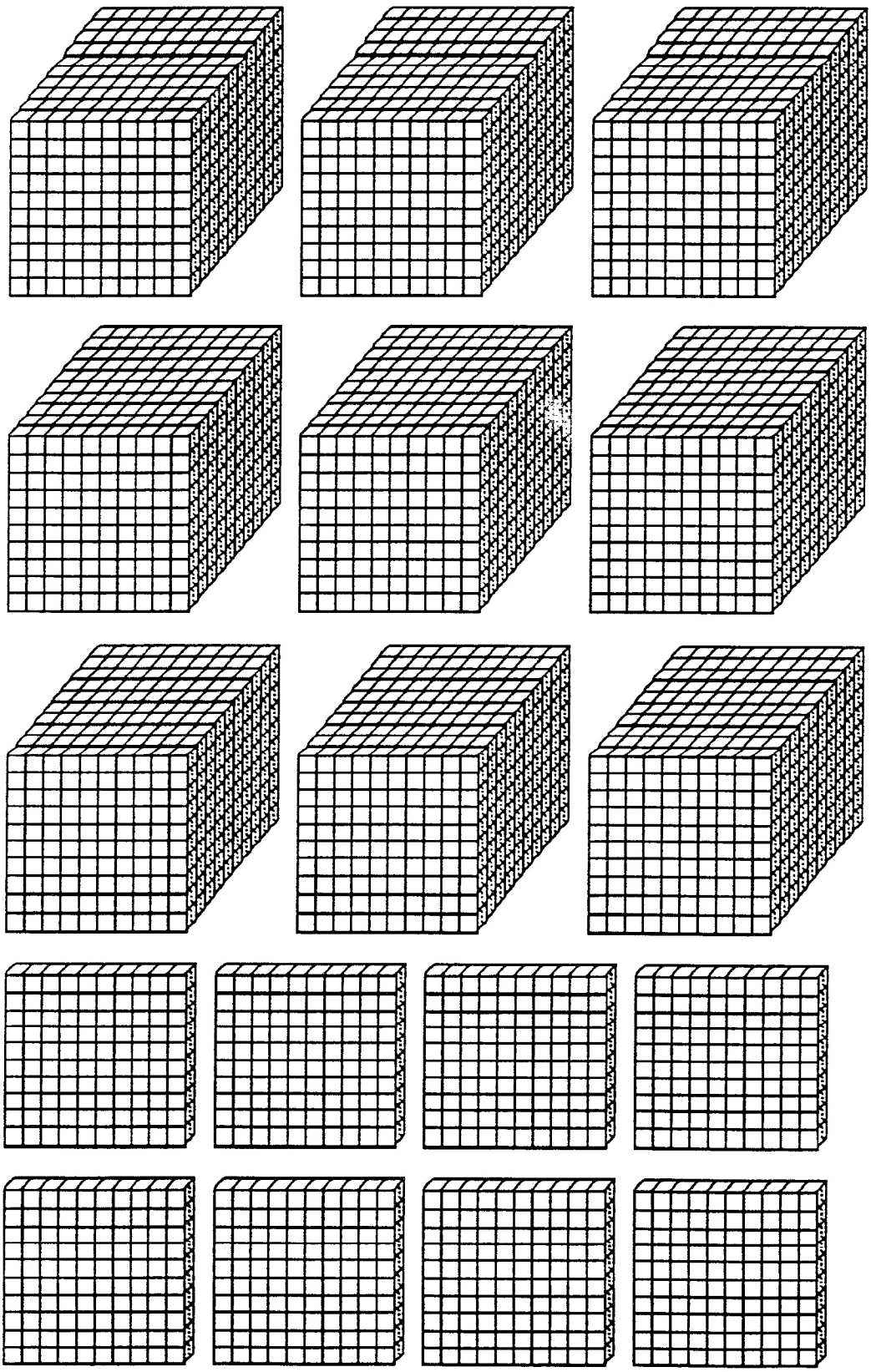
## Base 10 Block Cut-Outs



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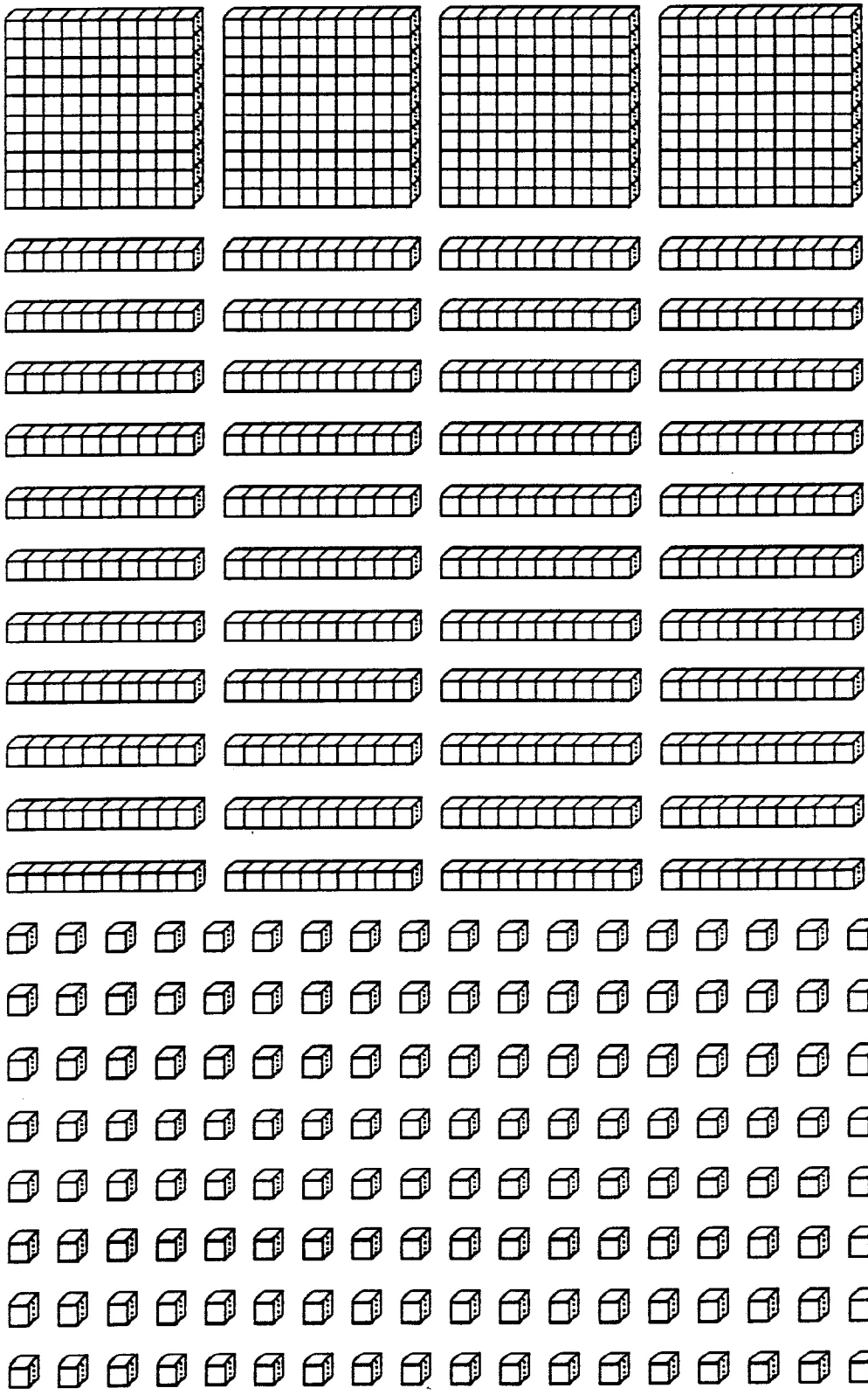
## Base 10 Block Cut-Outs

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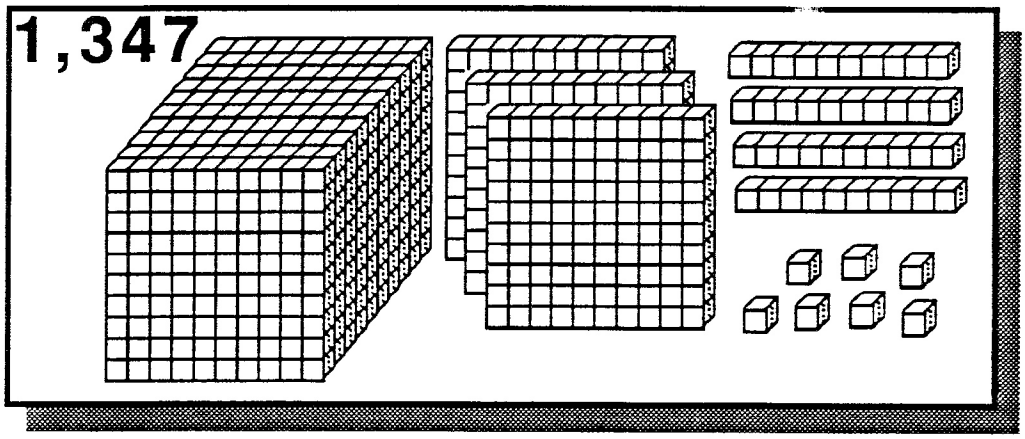
## Base 10 Paste Up

Paste cut-outs of base 10 blocks in the space to the right of each number to show the numeral. Study the first example.

1. 1,347



2. 1,261

3. 724

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## More Base 10 Paste Ups

Paste cut-outs of base 10 blocks in the space to the right of each number to show the numeral.

4. 3,214

5. 1,357

6. 407


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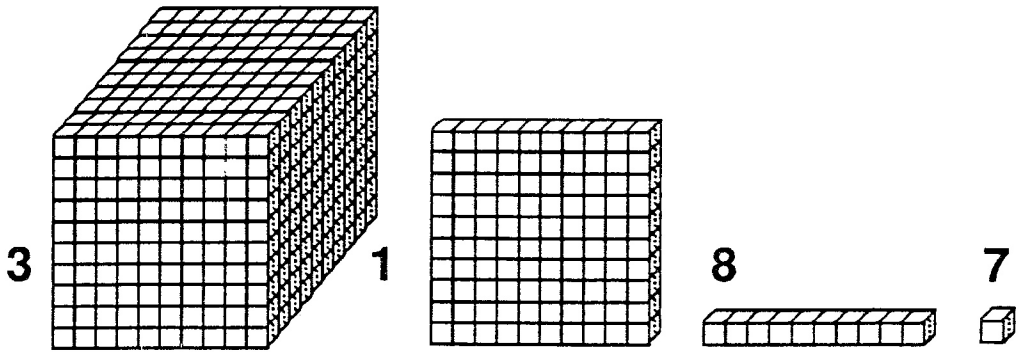
## Writing Numbers in Expanded Notations

Numbers can be written in expanded notation. In this example each digit is written as a product. The expanded number is written as the sum of products.




**3,187**

**(3 x 1,000) +( 1 x 100) + (8 x 10) + (7 x 1)**

Show each number with blocks on the Base 10 Blocks Playground. Write each number in expanded notation.

| | Expanded Notation |
|---|---|
| 3,165 | |
| 1,442 | |
| 3,091 | |
| 2,158 | |
| 279 | |
| 1,055 | |
| 1,302 | |
| 723 | |

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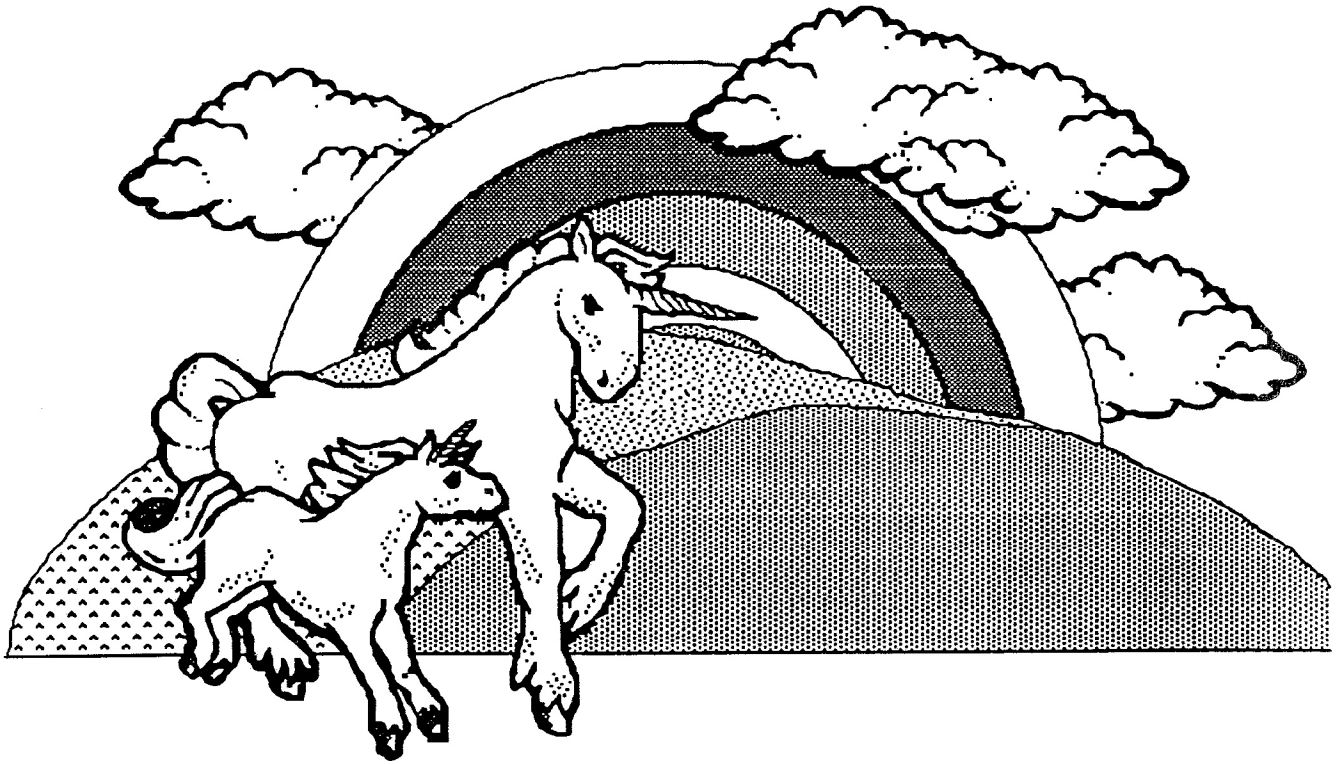
Name:_____ Date:_____

## Four Place Addition with Regrouping

Use the Addition Skills program to complete this page. Set the Random Option to "Off". Enter each addend and use the computer to find the sum.

Write your answers on this page.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | 1,052<br>+3,221 | 2. | 2,161<br>+1,288 | 3. | 2,001<br>+4,028 | 4. | 2,901<br>+1,268 |
| 5. | 3,200<br>+1,913 | 6. | 1,299<br>+1,877 | 7. | 1,079<br>+3,278 | 8. | 1,079<br>+1,421 |
| 9. | 327<br>+1,228 | 10. | 927<br>+1,098 | 11. | 1,466<br>+1,209 | 12. | 1,246<br>+1,958 |

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**Marilyn Grover, M.A.**

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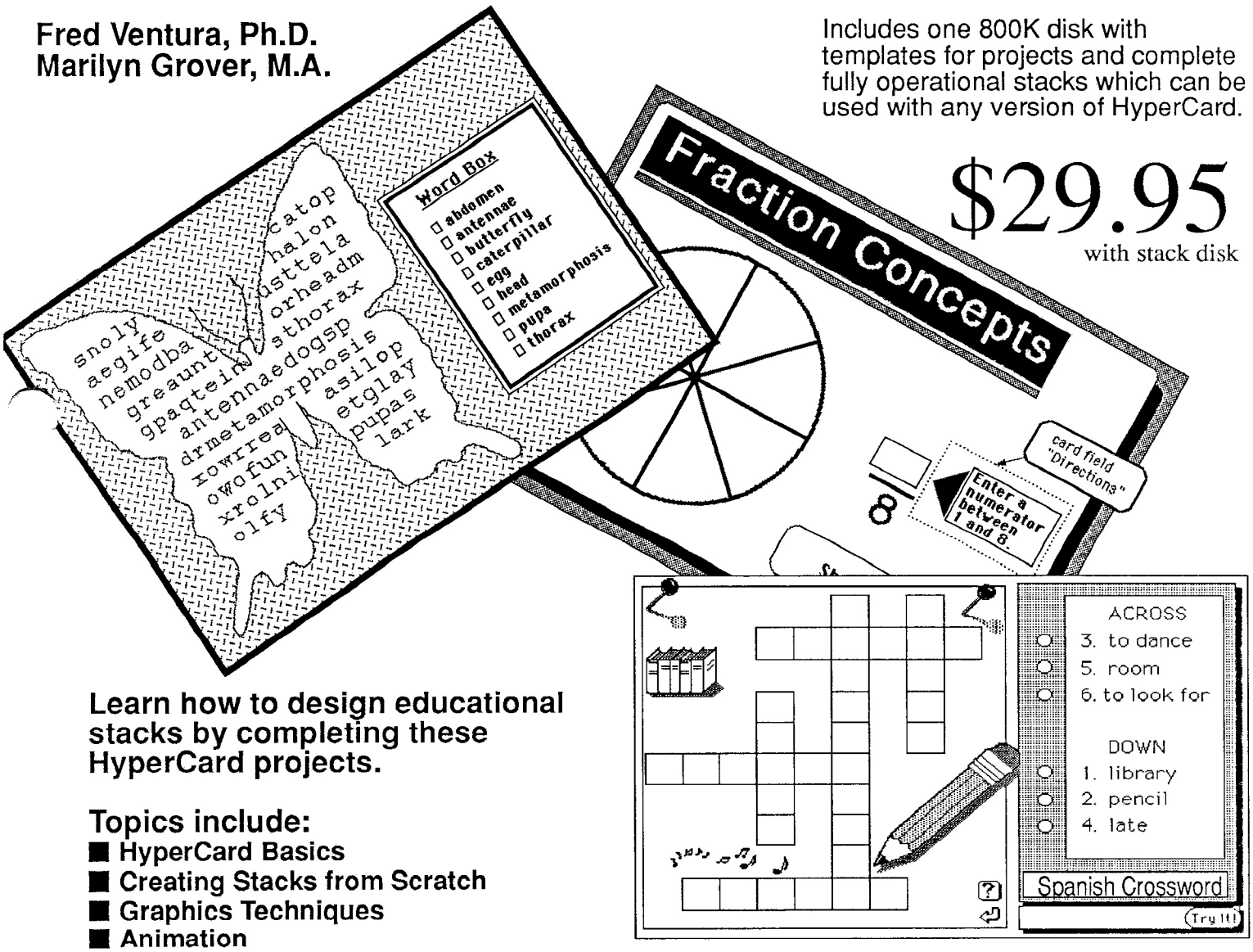


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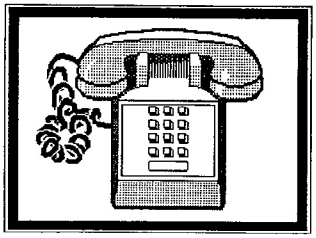

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|---|---|---|
| Name | | |
| School | | |
| School Address | | |
| City | State | ZIP |

| Bill to: | | |
|---|---|---|
| Name | | |
| School | | |
| School Address | | |
| City | State | ZIP |

Check one:

- ☐ Bill me (school address required). Shipping and handling is extra.
- ☐ Send programs listed below. Purchase order is enclosed.

If you are not completely satisfied you may return the program in good condition within 30 days for a refund or cancellation of the bill.

| Title and Format | Single | Lab-Pack | Quantity | Price | Amount |
|---|---|---|---|---|---|
| | | | | | |
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| | | | | **Subtotal** | |
| | | | | **Tax (in CA)** | |
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